

**SAMPLE PAPER I , 2019- 20
CLASS-XII**

MATHEMATICS

Time : 03 Hrs

Maximum Marks: 80

General Instructions:

- 1 All questions are compulsory.
- 2 The question paper consists of 36 questions, divided into 04 sections A,B,C,D
- 3 Section A comprises of 20 questions of 01 mark each.
- 4 Section B comprises of 6 questions of 02 marks each.
- 5 Section C comprises of 06 questions of 04 marks each.
- 6 Section D comprises of 04 questions of 06 marks each
- 7 There is no overall choice, however internal choices are given in the question paper .

SECTION-A

Question numbers 1 to 20 carry 1 mark each

1. Write the number of all one – one functions from the set $A = \{a , b , c \}$ to itself
2. What is the principal value of $\cos^{-1} \left(\cos \frac{3\pi}{4} \right) + \sin^{-1} \left(\sin \frac{3\pi}{4} \right)$.
3. Find the principal value of $\cos^{-1} \left(\frac{1}{2} \right) - 2\sin^{-1} \left(\frac{-1}{2} \right)$
4. Evaluate $\tan^{-1} [2 \cos (2 \sin^{-1} \frac{1}{2})]$
5. If A is a square matrix satisfying $A^2 = I$, then what is the inverse of A ?
6. Using determinants ,find the area of the triangle whose vertices are (-2, 4) (2, -6) and (5, 4)
7. A square matrix A , of order 3 ,has $|A| = 5$, find $|A \cdot \text{adj } A|$.

8. Suppose Ram goes to a market and purchases : two apples , six lemons and five mangoes. Construct the 1×3 matrix where row gives the various purchases of Ram.

9. If $f(x) = x^2 + 2x + 7$, find $f'(3)$

10 .If $A = \begin{bmatrix} ab & b^2 \\ -a^2 & -ab \end{bmatrix}$ evaluate A^2

11.If A is a square matrix, write the condition on A such that $|A^{-1}| = \frac{1}{|A|} = |A|^{-1}$.

12. If A and B are non singular square matrix of the same order, than write the relationship between $\text{adj } AB$, $\text{adj } A$ and $\text{adj } B$.

13If P is a square matrix of order 2 , such that $|P^3| = 1$. Find $|P|$

14.Evaluate : $\int \tan x \, dx$

15. Write the value of $\int_0^{\pi/2} \sin^2 x \, dx$

16. Using differential find the approximate value of $(0.082)^{1/2}$

17. Show that $y = e^x$ has no local maxima or local minima

18. Find the rate of change of the area of a circle with respect to its radius r when $r = 6$ cm

19. Show that the function $f(x) = 4x^3 - 18x^2 + 27x - 7$ is always increasing on \mathbb{R}

20. ..Find the equation of the line joining $A(1,3)$ and $B(0,0)$ using determinants and find k if

$D(k, 0)$ is a point such that area of triangle ABD is 3 sq units.

SECTION – B

Question numbers 21 to 26 carry 2 marks each

21. At what points of the ellipse $16x^2 + 9y^2 = 400$ does the ordinate decrease at the same rate at which the abscissa increases ?
22. Show that the function : $f(x) = \cot^{-1}(\sin x + \cos x)$ is a strictly decreasing function in the interval $(0, \pi/4)$
23. If $e^y(x+1) = 1$, show that $dy/dx = -e^y$
24. For the curve $y = 5x - 2x^3$, if x increases at the rate of 2 units / sec then find the rate of change of the slope of the curve when $x = 3$
25. Obtain the differential equation of the family of circles passing through the points $(a, 0)$ and $(-a, 0)$
26. Evaluate $\int \frac{\sin x}{\cos^{-1} x} dx$

SECTION – C

Question numbers 27 to 32 carry 4 marks each

27. Using properties of the determinants prove the following

$$\begin{vmatrix} 3a & -a+b & -a+c \\ a-b & 3b & c-b \\ a-c & b-c & 3c \end{vmatrix} = 3(a+b+c)(ab+bc+ca)$$

28. If $x = a \cos \theta + b \sin \theta$, $y = a \sin \theta - b \cos \theta$ show that $y^2 d^2y/dx^2 - x dy/dx + y = 0$
29. Solve the following differential equation : $(x^2 + 3xy + y^2) dx - x^2 dy = 0$ given that

$y = 0$, when $x = 1$

30. Separate the interval $[0, \pi/2]$ into subintervals in which the function $f(x) = \sin^4 x + \cos^4 x$ is strictly increasing or strictly decreasing.

31. Evaluate $\int_0^{\pi/2} \frac{1 + \sin x}{\sin x} dx$

32. Let S be the set of all rational numbers except 1 and $*$ be defined on S by

$$a * b = a + b - ab, \text{ for every } a, b \in S \text{ Prove that}$$

a) $*$ is a binary on S

b) $*$ is commutative as well as associative.

SECTION – D

Question numbers 33 to 36 carry 6 marks each

33. Using integration, find the area bounded by the tangent to the curve $4y = x^2$ at the point $(2, 1)$ and the lines whose equations are $x = 2y$ and $x = 3y - 3$

34. Using matrices, solve the following system of equations :

$$x + y + z = 3; \quad x - 2y + 3z = 2 \text{ and } 2x - y + z = 2$$

OR

Using elementary transformation, find the inverse of the following matrix:

$$\begin{bmatrix} 1 & 1 & 1 \\ 2 & -1 & 1 \\ 1 & -2 & 3 \end{bmatrix}$$

35. Prove that the radius of the base of right circular cylinder of greatest curved surface area which can be inscribed in a given cone is half that of a cone.

OR

Prove that the volume of the largest cone that can be inscribed in a sphere of radius R is $\frac{8}{27}$ of the volume of the sphere .

36. Using properties of definite integral, evaluate : $\int_0^{\pi} \frac{x \tan x}{\sec x + \tan x} dx$